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PRESS REVIEW

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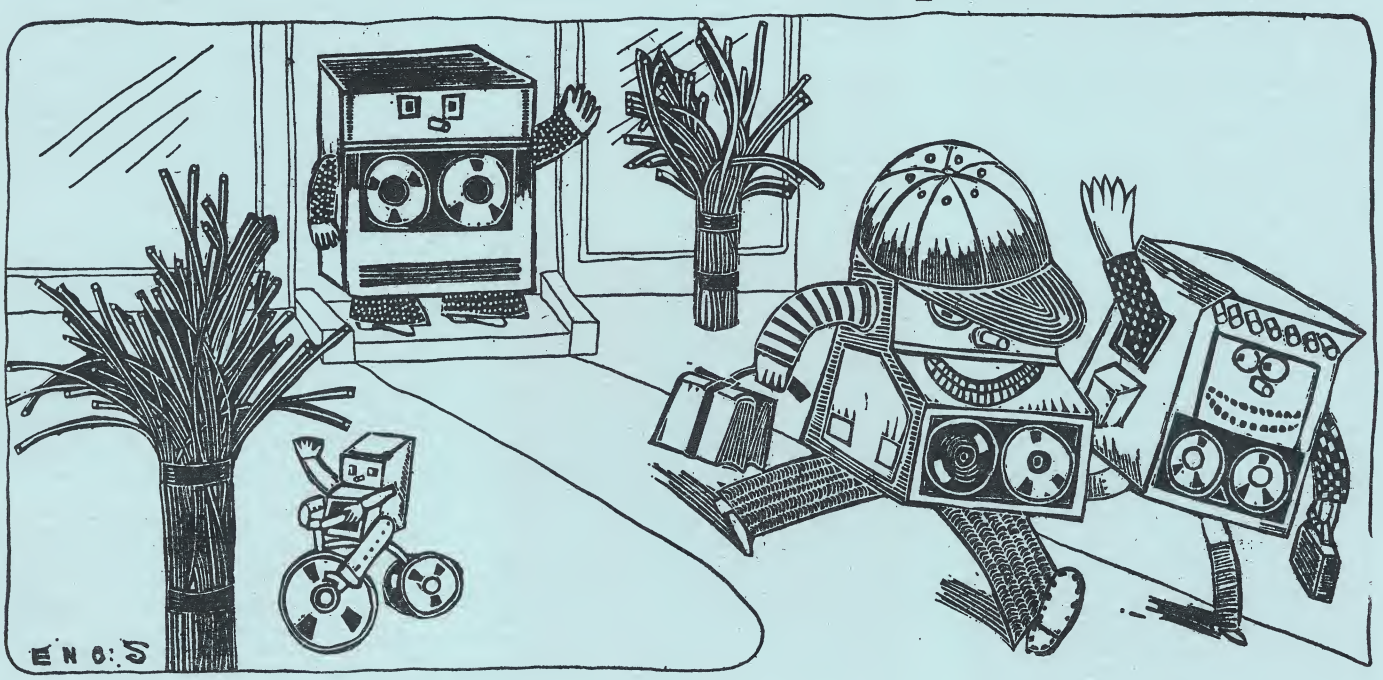
Mini Revolution in the Computer World



Time-Sharing Loses Ground As Small Units Boom in Sales

By STANLEY KLEIN

Among the nation's technology leaders, Bell Laboratories is highly regarded for its expert management, and mistakes in decision-making at this major subsidiary of the American Telephone and Telegraph Company are considered rare.

But missteps occasionally do occur, and William O. Baker, the Bell Laboratories president, admits that one of them involved minicomputers—the compact, task-oriented machines that are suddenly taking over many of the functions once performed only by big data processing systems.

"We originally thought that big central computers could handle all of our management information work," said Mr. Baker. That was back in the mid-1960's, when most experts believed that the big computers made by the International Business Machines Corporation, the Control Data Corporation and the Univac division of the Sperry Rand Corporation, among others, would provide all the data processing power needed by any organization.

In those years, before the potential of the minicomputer was recognized, the concept of big, central computers providing service akin to an electric utility was in vogue. Business offices, laboratories, factories, even private houses would have access to computers through terminals connected to telephone lines.

Such computer time-sharing services do exist, but now the minicomputer has relegated that grandoise concept to a niche in the data processing industry. The Bell System, having caught up on its miscalculation, now deploys thousands of minicomputers to keep track of equipment orders, telephone network usage and many other operations. "This is what we though we could do using just large, central computing systems," Mr. Baker said.

"The future belongs to the minis and the micros," said Eric D. Wolfe, a senior computer scientist who heads the Washington office of Bolt Beranek and Newman, a consulting firm. In scarcely more than a decade, minicomputers have turned into a $3 billion industry, and no end to the growth is in sight.

At a cost of a few thousand dollars, a minicomputer can be dedicated to carrying out a single job—doing a payroll, running a laboratory experiment, controlling a machine and so on—in lieu of using a central computer to handle all of the same tasks or any combination of them.

The Digital Equipment Corporation in Maynard, Mass., pioneered the concept of small computers in the early 1960's. After the company introduced the first mass-produced commercial minicomputer in 1965, the company's annual report boasted: "In the eight

months between our announcement and the end of June, more than 200 of the computers were sold."

Installations of that basic Digital Equipment model, the PDP-8, have soared to 37,000 worldwide. Moreover, the company, which accounts for about 35 percent of the minicomputer market, has sold some 72,000 minis of all types, including newer systems that would have been considered supercomputers if they had been introduced 10 years ago. Digital Equipment's annual sales volume has climbed from $15 million in 1965 to the $1 billion that the company is expected to report for the fiscal year ending next June 30.

Such growth has become almost typical throughout the field of minicomputers and associated products—printers, terminals, communications gear and the like. Data General, Microdata Computer Automation, Applied Data Systems, Sycor, Datapoint, Codex, Basic Four and scores of other relatively new companies have joined in the boom.

Such well known concerns as Texas Instruments, Burroughs, Honeywell, the NCR Corporation, I.B.M., Control Data, Sperry Rand, Hewlett-Packard and Perkin-Elmer are also involved. Moreover, the consensus is that the industry is still in its infancy. "For this industry to stop growing, a disaster would have to strike the country," said Roland Thomas, a Data General vice president.

By any of a variety of measures, Mr. Thomas's perception seems justified. Price-earnings ratios that measure investor expectations are typically higher for the shares of small computer companies than they are for any other stock group, despite the recent big tumble in the group due to investor concern over the fierce competition in the field. The I.B.M. Series/1 minicomputer introduction last fall is an even more telling commentary on the outlook for the small computer. "I.B.M.'s timing could not have been better," exclaimed one industry source, citing the stretched-out deliveries from Digital Equipment, running six months and longer on certain product lines.

Such strong demand results from a continuing decline in the cost of the technology. The PDP-8 that cost $18,000 at the time of its introduction 12 years ago now costs $2,000. Because of such favorable economics, some big companies have begun to break out part of the data processing load that traditionally was concentrated in one central computer and, instead, are turning jobs over to minicomputers.

The lustiest of all the minicomputer growth markets, however, is now the small business application that makes it economic for companies in the $1 million to $10 million sales range to afford a computer on their premises to perform payroll, billing, accounting and other functions. A study by market researchers Frost & Sullivan in New York forecast that such systems, now totaling about 100,000 installations nationwide, will soar to 460,000 installations by 1984. Total value of the new equipment and software to be installed: $17 billion.

The reason for the minicomputers' popularity is that they can do almost anything that the programming instructs them to do. Nevertheless, such small computers do have limitations. They cannot store as much data as the big machines, nor can they process their jobs as fast, and they are limited also to the number of jobs that they can handle at one time. According to Mr. Wolfe of Bolt, Beranek and Newman, "there will always be a place for the big central processors."

But it's from the opposite end of the size scale, the microcomputer, that trouble signals can be seen. The same semiconductor technology that makes up much of the minicomputer's innards and that rendered the small computer an effective rival to the big main-frame computer continues to work its magic.

Engineers can now cram all of the computer circuitry onto a silicon chip that measures about the size of a pinky nail. This is the so-called microcomputer and it could some day impinge on the growth of its bigger minicomputer brethren. Indeed, an annual survey conducted by Modern Data Services Inc., a research and publishing concern based in Hudson, Mass., already shows that about 16 percent of potential minicomputer buyers opted in 1975 for the computer on a chip instead.

For the moment, however, the performance of the microcomputer is too limited to handle most of the jobs the minicomputer is called upon to do, so the micro devices are finding a home in video games, electronic timepieces, appliance controls and other applications where, in essence, they supplant traditional integrated-circuit electronic technology.

Nevertheless, all of the technology is changing so swiftly that anything can happen. As a hedge, Digital Equipment, Data General and Texas Instruments have all devised microcomputers to complement their minicomputer product lines. And at this level the mini companies will some day buck up against such powerful semiconductor companies as Intel, Fairchild Camera and Instrument, National Semiconductor, Motorola and others.

The market growth of the minicomputer will expand some 12-fold over the next 10 years, according to another Frost & Sullivan study, but it will be exceeded by that of the microcomputer: its market growth over the same time frame will be an astounding 150-fold.

Education

Time-Sharing in Education Going, Going, But Not Gone

Time-Sharing Confronted with Standalone Computers As Educational Institutions Examine One-on-One Approach

When time-sharing was aborning, it was explained that the technique would allow many users to share the processor simultaneously as though each had exclusive use of the large machine. Terminals subsequently became almost as commonplace as the telephone. But in the 10 or so ensuing years, dramatic reductions in the cost of electronics have brought to the marketplace computers that are cheaper than some terminals.

What follows, then, is a natural consequence. Do away with the terminal and modem, avoid the phone line charges and, instead, get your own machine. Some people call this one-on-one.

And it's exactly what the University of California currently is looking into for instructional computing. Not a computer for each student, alas, but a sufficient number of standalone machines to accommodate students who must write, debug, and test programs to satisfy classroom assignments, as well as those who just want to learn what a computer can do.

Terminals out at Pasadena

At the Pasadena Polytechnic school, a high school in southern California, they've just replaced their three terminals, which were time-sharing the Cal Tech computer across the street, with three small systems. It's not such a new or startling idea, says supplier Gene Murrow. "It predates time-sharing. Before they had time-sharing, they had one-on-one—one user and a $450,000 computer!" says Murrow, who is supplying three $1800 computers.

Murrow is president of fledgling Computer Power & Light Inc., Studio City, Calif. His microcomputer-based Compal-80, priced at a mere $1,863, comes equipped at that price with 12K bytes of read-write storage, 1K of PROM, a nine-inch crt and keyboard, Extended Basic, and the facility to attach an ordinary audio cassette recorder for auxiliary storage. The system has been purchased by a number of schools in the Los Angeles area.

The concept of one-on-one is as natural to youngsters as the personal automobile is to their parents. It's the age of transistorized radios for bicycles and of supermarkets selling pocket calculators for less than $10. The home electronic video game, which attaches to the tv set, found its place under many a Christmas tree last year. Indeed, Creative Strategies Inc. has projected sales of such games at 17 million by 1980, saying that prices for such games "will fall more rapidly than most industry members recognize." The San Jose, Calif., research firm foresees prices for the low-end, limited-feature games dropping from $35 last year to $20 this year.

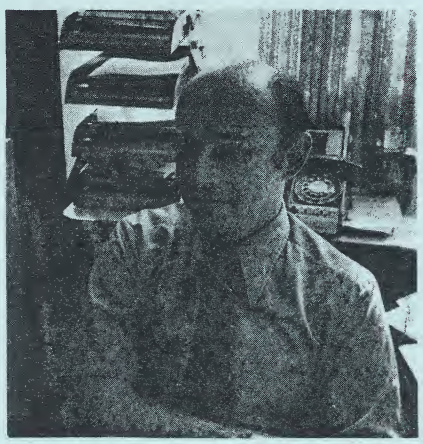
THE $1800 Compal-80 system being used by a number of schools for instructional purposes is shown by Gene Murrow of Computer Power & Light.

Reeducate users

Murrow, a former math teacher who has been writing instructional programs for years, is convinced there's a place for small computers, too. But he finds he must reeducate users to the idea that three machines, or 32 of them, are better than an equal number of terminals sharing a larger machine. For one thing, a 32-machine facility can have one system crash and still have 31 running. "Also, it's much less likely to crash because it's such a simple operating system," he says. "The one-on-one is so much simpler than these complex time-sharing systems."

He adds that this is especially appealing to school systems, which are delicious targets of bright students whose sole aim is to crash the system. Students love getting into the system exec and into restricted memory. They can do the same with a Compal-80, but then they've crashed only one system, which can be reloaded in 30 seconds.

Educational consultant LeRoy Finkel of Menlo Park, Calif., recalls the big debate in schools not so long ago. It was over whether students should be allowed to use handheld calculators during exams. One of the strong arguments against it was that many students couldn't afford those $200 calculators. "With the prices down to $25," he says, "that argument gets destroyed. Maybe the concept of the future will be that everyone will have to have a home computer."



STANDALONE computer systems for less than $5,000 each are considered ideal by the Univ. of California's Charles W. Stevenson. He prefers them over time-sharing terminals.

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Stanford's approach

The problem of delivering computing services to students is being addressed anew this year by Stanford University, which has installed a Digital Equipment Corp. 2040 with 48 terminals. This is being called LOTS, for low overhead time-sharing. The system can be staffed by only four persons, costs $440,000 to install, and perhaps another $200,000 a year to operate. It will be for students and faculty only, not for those performing sponsored research work, and it will take an estimated 85% of such workload off the large campus computing facility.

Stanford's progression, from a large mainframe supporting both sponsored research work and students and faculty to the installation of a smaller machine to serve only the latter category, stands in interesting contrast to the program being anticipated by the University of California.

UC's problem with a 6400

This institution has 120,000 students and nine campuses, all with their own computing facilities for administrative dp, for research, and for instructional purposes. On the Berkeley campus, for example, students formerly submitted jobs in a batch mode to be run on the campus CDC 6400. But the first run, after an anxious wait, would only serve to inform the student that he was a terrible keypuncher—which he already knew. And subsequent submissions reinforced what he also suspected, that there were errors in his program. More recently the campus added two Digital Equipment PDP-11/70s.

"On either system, a student can get computing for a dollar an hour; and those are pretty capable systems," says Charles W. Stevenson, manager of computer planning for the university's Systemwide Administration. The two 11/70s offer two different operating systems and several languages. When the first machine was installed, it was predicted that terminal usage would range between eight and ten hours a day. "Their experience in the first six months was an average of 15 hours of use a day, seven days a week, on each of those terminals," Stevenson says. Based on the use of 25 terminals on each system, he says they can amortize the equipment over a two- to three-year period at a dollar an hour. "They're getting a lot of good computing at a buck an hour."

At that price, he adds, departments prefer the small systems. One professor predicts that within the next six months the campus will have three 11/70s and one 11/34. "And he considered that to be roughly equal to the capabilities of the 6400" at approximately the same price. "And yet one is far more approachable and has a lot more interest for instructional purposes."

Take that a step further and you have an even more approachable situation, the fabled one-on-one—a standalone machine for instructional computing. It's like a terminal, except that while the student sits at the keyboard he has the entire machine to himself. It would be portable—cumbersome, perhaps, but portable—and could be taken into a classroom for use there. "All you'd need is a three-wire outlet in the wall."

Why a terminal?

"Why buy just a terminal," Stevenson asks rhetorically, "and then add insult to injury by paying phone charges and the cost of modems and that sort of thing, when you can get what you really need for instructional computing in a standalone version for under five grand?"

He expects soon to be issuing an RFP for this machine. It would have a floppy disc or cassette, graphics capability, maybe in color, an interactive programming capability in some language such as Basic or APL, at least as much user space as in a multi-user time-sharing system, full typewriter keyboard, and some form of coursewriting software or firmware, such as Pilot or Dialog. And it should be able to communicate with a host computer, should that be desired, and to other devices, such as in laboratory experiments.

"My target price is five grand for that," Stevenson says. "I think it'll come in for less than that from what I've seen so far." In a few years, he adds, such a computer should be available for a third to a half of that price. At a unit price of $5,000, it's easy to figure how many can be purchased for the cost of installing and operating the larger time-shared systems over, say, a two- or three-year period.

The Compal-80, for example

To show that this is not an idle dream, he produces a brochure on the Compal-80 system, saying, "It doesn't take very many hours of use at a dollar an hour to pay for the use of that." He figures it would be less than 18 months. "Probably less than that if you have them in public areas where they're used to the extent that those terminals on the DEC machines are used on the Berkeley campus. And no phone charges."

He has also visited with other prospective vendors, some that regretfully can talk only in terms of a hierarchy of machines. "If you're talking about 200 of these standalone machines, they want you to get one of their big machines. If you want 50 of them, then they want to talk about their medium-sized machines, and if you need one to four, then they want you to get this other (smaller) one. But I think they're missing the point. Because in no case are those systems completely symmetric, and I think it's a mistake to go into this kind of a thing and assume that all systems will be in one particular kind of environment."

Stevenson wants to be able to allow professors to write their courseware, whether it's called computer-assisted instruction or computer-managed instruction, on the same type of machine. And allow them to do this in the privacy of their offices, at home, or in the same setting where students congregate. Vendors, unfortunately, want to provide profs with an expensive one-on-one machine to develop their courseware, overlooking the fact that the programs they develop won't necessarily run on the students' machines, and vice versa. There's no symmetry there. What's required is complete program transferrability without change.

Books vs. courses

He regrets the fact that few academic institutions give a prof equal credit for writing good courseware as for writing a book or technical paper, though hopeful that this will begin to happen. "Well done courseware may involve far more thought and careful preparation and money than writing a book," he says. When this is recognized, it may be possible to store the courseware on a floppy or cassette and sell it in campus bookstores with its companion workbook, thus providing a royalty to its creator. "People sell audio courses now; why not also sell digital courses?" Stevenson asks.

Nor would this be restricted to campus bookstores. What with the current boom in the hobbyist market and the anticipated proliferation of home computers, one could also sell, say, income-tax preparation programs, games, checkbook-balancing programs, and personal records inventory programs.

"I'm not saying these things will replace computing everywhere," Stevenson adds. "Not by a long shot. But it's for a class of instructional use that currently is not being handled very well by anybody—because it's either too expensive or it's unapproachable or you can't get money to pay for it."

—Edward K. Yasaki